DISTRIBUTION AND SPECIES OF 17-YEAR CICADAS IN BROODS V AND VIII IN OHIO[1]

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Abstract. The distributions of Broods V and VIII of 17-year cicadas, *Magicicada* spp., were surveyed in Ohio by collecting adults, recording male songs, mapping ovipositional "flagging" records, and using questionnaires. Brood limits in 1965 and 1968 showed signs of receding, primarily away from some large urban centers. Cicada populations of each brood were large and more widespread in southern Ohio. Populations were generally smaller and more isolated in northern counties. *M. septendecim* (L.) was found in 41 (probably 43) counties in 1965 and in six counties in 1968. *M. cassini* (Fisher) and *M. septendecula* Alexander and Moore were recorded from 34 and 23 counties, respectively, in 1965 (Brood V), but not from the northernmost counties. *M. septendecula* was not found in Ohio in 1968 (Brood VIII); *M. cassini* was collected from three counties.

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Clearing of woods for homes and farm lands has been considered as being instrumental in reducing the distribution of *Magicicada* spp. (Andrews, 1937; Marlatt, 1907; Parks, 1948). Since the last mapping of the distribution of Brood V in Ohio in 1931 (Parks, 1948), and of Brood VIII in 1917 (Gossard—unpublished records), there has been an increased utilization of forest land for roads, homes, industries, and farming. In previous surveys by Ohio entomologists, all 17-year cicadas were considered as one species, but today three species are recognized: *M. septendecim* (L.), *M. cassini* (Fisher), and *M. septendecula* Alexander and Moore. After searching insect collections and other available records, Alexander and Moore (1962) indicated that all three species were present in Ohio in Brood V, and only *M. septendecim* and *M. cassini* in Brood VIII. However, no complete survey of the distribution of these species within the State has been reported. I studied the current boundaries of Broods V and VIII in Ohio and the distribution of species of 17-year cicadas within these areas.

MATERIALS AND METHODS

The distribution of 17-year cicadas was determined from questionnaires returned by 74 orchardists in 1965 and 48 in 1968, and by 77 nurserymen in 1965; from reports by extension agents, state research workers, and private citizens; and from a systematic survey in June of every county within or bordering the previously recorded cicada emergence areas. At least one sample of adults was collected in each county where cicadas were present during the survey. County extension agents also submitted samples of adults (24 samples in 1965 and 3 in 1968). A second systematic survey was made of each brood area in mid- to late summer. At this time, wooded areas showing a fire-scorched appearance (flagging), due to extensive oviposition by the cicadas, were plotted on a road map. Questionable areas were examined more closely for evidence of cicada presence (egg slits, nymphal skins, dead adults). No flagged areas are shown on maps in this report unless they were more than 10 miles long.

Boundaries of Broods V in 1965 and VIII in 1968 were drawn with the aid of all positive and negative cicada reports. For comparison with previous Ohio Brood V and VIII distributions, I have reproduced the maps of Gossard (1916), Parks (1948), and Webster (1897; 1900). Since Gossard's map indicated only individual locations of the presence of cicadas, I added a boundary line to show the outermost limit of Brood V. The data for determining the boundary of Brood VIII in 1917 were obtained from Gossard's original unpublished records.

Cicada adults were assigned to species according to descriptions given by Alexander and Moore (1962). Confirmation of tentative identification of 25 border-line specimens of *M. cassini* and *M. septendecula* in 1965 was made by T. E. Moore, University of Michigan. In 1965, additional species records, based on the song of male cicadas, were supplied by T. E. Moore; R. S. Soper, formerly with Canadian Depart-

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RESULTS AND DISCUSSION

BROOD V. This brood is found in most of eastern Ohio and is considered a major one (Marlatt, 1907). A comparison of the distribution in 1965 with those recorded by three other observers is presented in figure 1. In Gossard's map for 1914, the numerous "peninsula-like" extensions of the brood limit were generally due to the inclusion of one or two reports of cicadas. Examination of his detailed data revealed that peninsulas included in this category (i.e. only one or two reports) extended west into Pickaway, Ross, and Scioto Counties, south into Lawrence, north into Erie, and east into Columbiana and Trumbull Counties (two peninsulas in Trumbull). I found a similar situation in 1965 for the brood boundary extending east into Ashtabula County, west into Huron, and south into Scioto. No other map shows the Ashtabula peninsula, although Webster (1897) mentioned that cicada emergence was noted in western Ashtabula in 1863 and 1880. Webster recorded two narrow

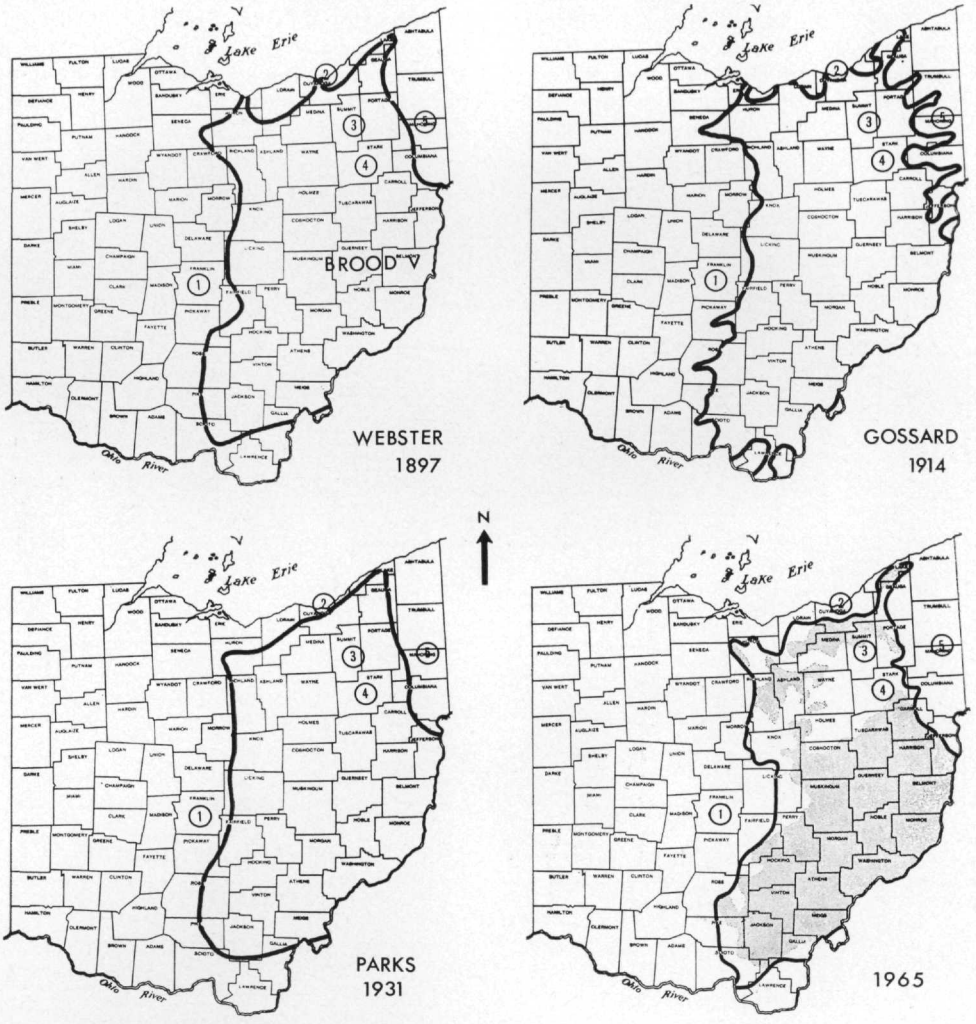

FIGURE 1. Limits of Brood V in Ohio, 1897, 1914, 1931 and 1965. Extensive cicada ovipositional activity (flagging) indicated by shaded areas. 1=Columbus; 2=Cleveland; 3=Akron, 4=Canton; 5=Youngstown.

peninsulas in 1897, both northward to Lake Erie, and commented that the cicadas at the ends of the peninsulas will probably never be heard of again. Gossard recorded cicadas from the Cuyahoga County location during the 1914 emergence, however, and the same location was considered as a possible, but unconfirmed, record for 1965. These observations suggest that cicada appearances in relatively small, isolated locations may be more persistent than originally supposed and that recession of a peninsula may not be evident during the next brood emergence. The non-existence of peninsulas in 1931 indicates that some precision may have been sacrificed by Parks for ease in plotting the boundary line.

If we ignore the peninsulas just discussed and consider only the main portion of the brood, the brood limit has been relatively stable from 1897 to 1965. Two areas, however, show a distinct trend towards a recession of the boundary line. One recession is apparently taking place in the counties immediately east of the city of Columbus, especially in Licking County. The other is occurring to the west and south of Youngstown. There is some indication that cicadas are disappearing east of Cleveland. The area south of the city proper is becoming urbanized but the 17-year cicadas are more numerous than I would have expected. A possible reason for the preservation of the brood limit here is that the park system and suburbs in southern Cuyahoga County contain many old, large and well-established stands of deciduous trees.

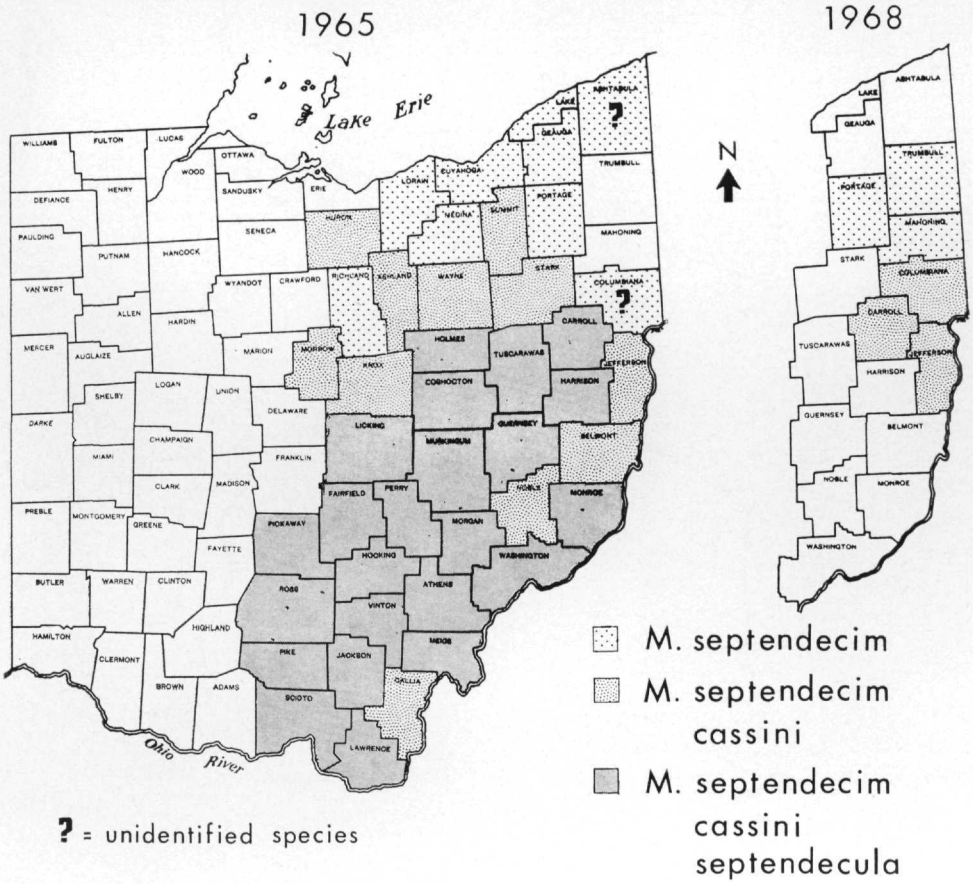

FIGURE 2. Ohio county distribution of 17-year cicada species in Brood V (1965) and Brood VIII (1968).

My data on the brood limit in Lake and Geauga Counties agree closely with Gossard's records. We both found an active cicada population in Lake County and no cicadas in the middle portion of the narrow isthmus connecting Lake County with the main part of Brood V. Webster (1897) used the term "cicada island" to designate an isolated cicada area within the brood limit; in the situation encountered in Lake County, the island is located outside the main brood area.

Data on areas with extensive ovipositional injury in 1965 support the recession of the boundary line east of Columbus and west of Youngstown (fig. 1). They also emphasize the development of a "cicada island" in Lake County, and the potential future development of islands within the northern part of Brood V. More extensive flagging was found in southeastern Ohio where the land is generally hilly, underdeveloped, and forested. In the northeastern part of the state, woodlands are more isolated and less extensive due to urbanization, industrial development, and intense farming. One area with much flagging was located directly south of Cleveland.

The presence of all three species of 17-year cicadas in Brood V was confirmed in 1965 (fig. 2). *M. septendecim* was recorded from 41 counties and probably was also the species involved in the reports from Ashtabula and Columbiana Counties (the reports were confirmed, but no species' identification was made). It was the only species recovered from the northernmost counties.

M. cassini was found in 34 counties, and *M. septendecula*, in 23 of the most southern counties. Percentages of *M. cassini* adults in each county in which 15 or more cicada specimens were collected at more than one location illustrate that *M. cassini* was more abundant in the southern part of the brood area. Approximately 24–92% of the adults were *M. cassini* in counties south of Harrison, Guernsey, and Muskingum; in northern counties the percentages were 0–22%. The number of *M. septendecula* adults had no influence on these percentages because so few were collected; only in Meigs County did the percentage of *M. septendecula* exceed 5%. Similar trends in geographical distribution of cicada species have been noted by Alexander and Moore (1962) and Lloyd and Dybas (1966).

BROOD VIII. Marlatt (1907) called

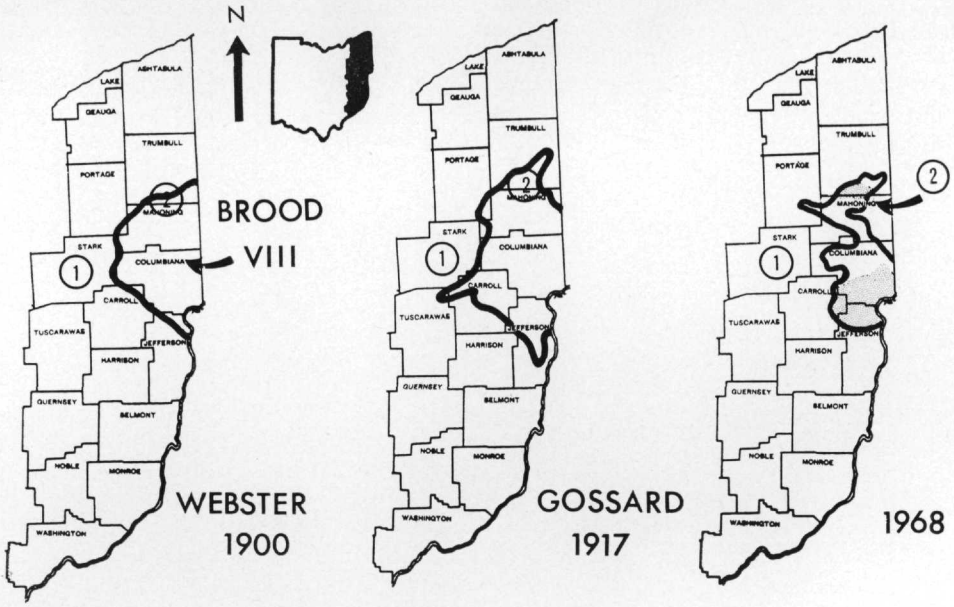

FIGURE 3. Limits of Brood VIII in Ohio. Extensive cicada ovipositional activity (flagging) indicated by shaded areas. 1=Canton; 2=Youngstown.

this brood a minor one. In Ohio it occupies a small area in the extreme eastern part of the state. The only mappings of Brood VIII prior to 1968 were by Webster (1900) and by Gossard in 1917 (unpublished data) (fig. 3). It appears that some recession of the brood limit is occurring in the northern part, east of Canton and west and southeast of Youngstown. Continued recession of the boundary line at these points may eventually result in a splitting of the brood in Ohio into two parts, although cicadas were present at several locations in the isthmus in Mahoning County. The possibility of a split is supported by data on areas with widespread ovipositional activity in 1968.

The peninsula recorded by Gossard as extending into Trumbull County was still present in 1968. I could find no evidence of the existence of the 1917 brood extensions south into Jefferson County and west into Tuscarawas. The peninsula extending west into Portage County in 1968 will most likely disappear within the next two brood emergences, because the cicada population at the tip was relatively inactive.

The presence of *M. septendecim* and *M. cassini* and the absence of *M. septendecula* in Ohio's portion of Brood VIII was confirmed in 1968 (fig. 2). *M. septendecim* was present in all six counties, and *M. cassini*, only in the three southernmost ones. The percentages of *M. cassini* adults in collections were 2, 7, and 19% in Columbiana, Jefferson, and Carroll Counties, respectively.

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